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THE UNSEEN UNIVERSE

The Unseen Universe; or, Physical Speculations on a Future State. (London: Macmillan and Co., 1875.)

THIS book, which rumour attributes to a co-partnery of two distinguished physicists, will at least serve to prove one thing, that scientific men are not necessarily unbelievers, and that some scientific men accept frankly and fully the whole of what is generally understood as the scheme of Trinitarian Christianity, and find in it the most adequate expression of their own physical speculations. Whether their readers agree with or differ from the authors, they cannot fail to recognise the extent of their information and the freedom of their reasoning. There is no attempt to make anything square with preconceived theories, and although we doubt whether the writers would have arrived at their conclusions without the accepted scheme of orthodox Christianity to serve them as a clue, it is equally clear that they rest them on what they think adequate scientific evidence.

The preliminary chapter states the fact of the all but universal belief in, or aspiration after, Immortality. It admits that that doctrine is inconsistent with the doctrine of continuity as generally understood and as applied solely to the visible universe. It accepts and explains the principle of continuity in the fullest sense, and it attempts to reconcile it, as thus apprehended, with the doctrine of immortality. Incidentally—out of the apparent waste of energy in space, and on other indications chiefly teleological—it constructs a hypothesis of an invisible universe, perhaps developed out of another invisible universe, and so on *ad infinitum*. It is another consequence of the theory that our natural bodies are probably accompanied by a sort of invisible framework or spiritual body, and that the phosphorus and other substances of which the natural body is built up are not really identical with these elements in their ordinary condition of inorganic atoms, but are somehow transubstantiated by the co-existence, along with the mere chemical substance or with its chemical properties, of this invisible, imponderable, immaterial, accompanying essence, which derives a kind of *vis vivida* from a connection with the unseen universe. The passage from the visible universe to the invisible seems to be made intelligible to the authors by the existence of the ether, a substance into which energy is continually being passed, and into which it is perpetually, and, so far as any obvious or sensible effect is concerned, finally, absorbed.

As a first postulate the authors assume the existence of a Creator. Finite beings, creatures, are conditioned by the laws of the universe, and it is in these conditions that we must seek to discover its nature. The first pair of subjects for human thought are matter and mind, and the materialists tell us, that whereas mind or mental activity never exists without being associated with some forms of matter, we may perfectly conceive matter, as for instance a block of wood or a bar of iron, existing without intelligence. Is mind then the dependant—is there nothing in matter which serves as the vehicle of intelligence different from all other matter? The authors answer that we have no right to assume that the brain consists of particles of phosphorus or carbon such as we know these substances chemically, that we cannot say that there may not be something superadded to their chemical and physical qualities. They dwell upon another fact—the fact that individual consciousness returns after sleep or trance; a fact inferring some continuous existence. The assumptions of the materialist are less inevitable than he supposes. Turning to mind, finite conditioned intelligence, the authors ask, what is essential to it? It must have some organ by which it can have a hold upon the past, and such a frame and such a universe as supply the means of activity in the present. Outside they find physical laws, and they look on the principle of continuity as something like a physical axiom. By this principle we are compelled to believe that the Supreme Governor of the Universe will not put us to permanent intellectual confusion. It is in the nature of man, certainly in the nature of scientific man, to carry the explanation of everything back *ad infinitum*, and to refuse perpetually to grant what is perpetually demanded of him, that he has arrived at the inexplicable and unconditioned. On this principle scientific men have supposed themselves to prove that the physical universe must one day become mere dead matter. The authors consider that this is a monstrous supposition, although they grant that the *visible*, or by-sense-perceivable universe, *must in transformable energy, and probably in matter*, come to an end. They think that the principle of continuity itself demands a continuance of the universe, and they are driven to believe in something beyond that which is visible as the only means of explaining how this system of things can endure in the future, or can have endured for ever in the past. They see a visible universe, finite in extent and finite in duration, beyond which, o both sides stretching infinitely forward and infinitely backward, there is an invisible, its forerunner and its continuation. It is natural to infer that these two invisibles must meet across the existing finite visible universe. As we are driven to admit the invisible in the past and in the future, there must be an invisible framework of things accompanying us in the present.

What then is this present visible universe; and can we point to sure signs of this invisible substance which accompanies what may prove after all to be the mere shadow of things? Matter has two qualities. The first is that it is indestructible; the second, that the senses of all men alike point to the same quantity, quality, and collocation of it. Our practical working certainty of the existence of matter means (1) that it offers resistance to our imagination and our will; and (2) that it offers absolute resistance to all attempts to change its quantity. Certain other things—notably energy—are in the same sense conserved, and if we recognise the transmutability of energy of motion into energy of position, we may say that energy is equally indestructible with matter itself. But energy is undergoing a perpetual self-degradation. All other forms of energy are slowly passing into invisible heat motions, and when the heat of the universe has ultimately been equalised, as it must be, all possibility of physical action or of work will have departed. Mechanical effort cannot longer be obtained from it. The perfect heat-engine only converts a portion of the heat into work; the rest is lost for ever as an available source of work. There is indeed a sort of wild and far-off possibility by which a little more work *might* be got out of a uniform temperature universe, if we could suppose Clerk-Maxwell's demons—"mere guidance applied by human intelligence"—occupied in separating those particles of a heated gas which are moving faster than the average from those which are moving slower. But this is but a broken reed to trust, and it would at the best avail us little. What must happen in the existing physical system would be this: the earth, the planets, the sun, the stars, are gradually cooling; but infinitely numerous catastrophes by which the enormous existing store of energy of position may be drawn upon, may over and over again restore unequal temperature. The fall together, from the distance of Sirius, of the sun and another equal sun would supply the former with at least thirty times as much energy as can have been obtained by the condensation of his materials out of a practically infinite nebulous mass of stones or dust. But these catastrophes can only delay the inevitable. If the existing physical universe be finite—and the authors never seem to realise the speculative possibility that it may not be so—the end must come, unless there be an invisible universe to supplement and continue it.

What is the ultimate nature of matter, and especially of the ether, which is the vehicle of all the energy we receive from the sun? There have been four theories, for each of which something may be said. There is the Lucretian theory of an original, indivisible, infinitely hard atom, "strong in solid singleness;" Boscovich's theory that the atom or unit is a mere centre of force; the theory that matter, instead of being atomic, is infinitely divisible, practically continuous, intensely heterogeneous; and, finally, the theory of the vortex atom, a thing not infinitely hard and therefore indivisible, but infinitely mobile, so that it escapes all force which makes effort to divide it. What we call matter may thus consist of the rotating portions of a perfect fluid, which continuously fills space. Should this fluid exist, there must be a creative act for the destruction or production of the smallest portion of matter. Whichever of these theories we adopt, we must explain the simplest affection of matter—that by which it attracts other matter. There seems little possibility of doing so. The most plausible explanation is in Le Sage's assumption of *ultramundane corpuscles*, infinite in number, excessively small in size, flying about with enormous velocities in all directions. These particles must move with perfect freedom among the particles of ordinary matter, and if they do so we can understand how, through the existence of the ultramundane particles, two mundane particles attract inversely as the square of the distance. On this theory the energy of position is only the energy of motion of ultramundane and invisible particles—and a bridge is built between the seen and the unseen. These ultramundane particles are something far more completely removed from all possibility of sensible qualities than the ether which Sir William Thomson has attempted to weigh. Struve has speculated upon the possibility that it is not infinitely transparent to light, and his calculations, based on the numbers of stars of each visible magnitude, lead him to suppose that some portion of the light and energy from distant suns and planets may be absorbed in it. The ether is thus a kind of adumbration or foretaste of the invisible world. It may have certain of the properties of that world which is perceived by sense, but it is probably subject only to a few of the physical conditions of ordinary matter.

Let us look once more at the substance of the universe. We recognise that it is impossible to suppose any existing state but as the development of something pre-existing. To suppose creation, is to suppose the unconditioned. Creation belongs to eternity, and not to time. This being so, it is difficult to believe in the vortex ring theory, which regards the invisible universe as an absolutely perfect fluid. With an imperfect fluid, the eternity of visible matter which the vortex theory requires, disappears. Such a visible universe would be as essentially ephemeral as a smoke-ring—so that we may accept it as possible, if not probable, that the visible universe may pass away—that it may bury its dead out of its sight. In its present state we have three forms of development—Chemical, or Stuff Development, Globe Development, and Life Development. It is a question whether the ultimate atoms of chemists are really ultimate; whether some agent, like great heat, for instance, could not split them up into various groups of some primal substance like hydrogen. We see the prospect of a similar simplicity in the development of worlds on the theory of Kant and Laplace, which makes the systems of the universe the result of the gradual condensation of nebulous masses. In the end, all the masses of the universe must fall together—in the beginning there can have been no masses, everything being nebulous and discrete, even if ordinary matter be indestructible. The last state and the first state of the visible universe are thus separated from each other by a finite duration. A like simplicity may be reached in the development of life. Darwin has made it at least possible that all life may issue from some primordial life-germ. The complete refutation of the doctrine of abiogenesis—the practical proof that life issues only from life—leaves us still bound to account for that germ. There is no doubt that species develop varieties which may ultimately become distinct species, although there is little indication that the varieties of what was once one species are ever separated like species originally different, by a barrier of mutual infertility. A sufficient length of time might enable us to overcome this barrier. In all our developments—the substance development, the globe development, the life development—we are thus brought, in the end, to a something which we are not yet able to comprehend.

Turning from matter to the phenomena which affect it, we notice one singular set of phenomena in which things insignificant and obscure give rise to great lines of events. A whole mass of water, the temperature of which has been reduced below the freezing-point, suddenly crystallises on the slightest starting motion; a whole series of tremendous meteorological phenomena, such as hurricanes in the Indian Ocean, happen because certain positions of Mercury and Venus affect the sun's atmosphere, causing spots in his, and the condition of the sun affects the earth. Like the complicated series of effects which follow the pulling of the trigger of a gun, the effects are utterly disproportionate to their causes. Man is a machine of this unstable kind—some trivial change affecting the matter of the brain is all that i needed to set him in motion. May not other beings be capable of touching what we may call the hair-triggers of the universe? Whatever these agencies are, angels or ministering spirits, they certainly do not belong to the present visible universe. The writers examine the sacred records to confirm their speculations.

Thus, then, we have a visible and an invisible universe, and we have processes of delicacy in the former which at least suggest the action on it of agencies belonging to the latter. Let us look at the first phenomenon of the visible universe—the expenditure of energy in it. The sun's energy is issuing in what is apparently waste space just as it is issuing in that portion of space which is filled by our earth. What becomes of the energy—probably far more than half of that which proceeds from it—which proceeds apparently nowhere, speeding on with the velocity of light? Is it absorbed in the ether, and if so, what does the ether do with it? The writers suggest that the ether may preserve for intelligent beings the record of the past. But that seems scarcely sufficient use of the energies spent on it; the more so as the intelligent beings existing in the visible universe will certainly come to an end with it.

"We were led," say the authors, in a passage in which their whole theory is perhaps summed up, "to conclude that the visible system is not the whole universe, but only, it may be, a very small part of it; and that there must be an invisible order of things, which will remain and possess energy when the present system has passed away. Furthermore, we have seen that an argument derived from the beginning rather than the end of things assures us that the invisible universe existed before the visible one. From this we conclude that the invisible universe exists now, and this conclusion will be strengthened when we come to discuss the nature of the invisible universe, and to see that it cannot possibly have been changed into the present, but must exist independently now. It is, moreover, very closely connected with the present system, inasmuch as this may be looked upon as having come into being through its means.

"Thus we are led to believe that there exists now an invisible order of things intimately connected with the present, and capable of acting energetically upon it—for, in truth, the energy of the present system is to be looked upon as originally derived from the invisible universe.

"Now, is it not natural to imagine that a universe of this nature, which we have reason to think exists, and is connected by bonds of energy with the visible universe, is also capable of receiving energy from it? Whether is it more likely that by far the larger portion of the high-class energy of the present universe is travelling outwards into space with an immense velocity, or that it is gradually transferred into an invisible order of things? May we not regard ether or the medium as not merely a bridge between one portion of the visible universe and another, but also as a bridge between one order of things and another, forming as it were a species of cement, in virtue of which the various orders of the universe are welded together and made into one? In fine, what we generally call ether may be not a mere medium, but a medium *plus* the invisible order of things, so that when the motions of the visible universe are transferred into ether, part of them are conveyed as by a bridge into the invisible universe, and are there made use of or stored up. Nay, is it even necessary to retain the conception of a bridge? May we not at once say that when energy is carried from matter into ether it is carried from the visible into the invisible; and that when it is carried from ether to matter it is carried from the invisible into the visible

"If we now turn to thought, we find that, inasmuch as it affects the substance of the present visible universe, it produces a material organ of memory. But the motions which accompany thought will also affect the invisible order of things, and thus it follows, that '*Thought conceived to affect the matter of another universe simultaneously with this may explain a future state*' (see Anagram, NATURE, Oct. 15, 1874)."

Our notice has already extended so far that we shall not follow the authors into their examination of the Scriptures, and of certain Christian hymns in which the sentiments and feelings of the Christian world seem to them to be embalmed. We notice only two of the objections to their system, which they themselves state, and seem to us to fail to refute. It is said that "if energy is transferred from the visible into the invisible universe, its constancy in the present universe can no longer be maintained." The answer is, that this visible universe is not the whole universe, and that the conservation of energy principle is applicable only to the whole universe, visible and invisible together, except under special limitations. The retort is obvious, that in this sense, and except when these special limitations specially and finally remove the difficulty, the principle becomes unintelligible and useless. It is a mere theological dogma to say that what energy perishes in the visible passes into the invisible universe; and the dogma is worthless as a physical principle on which to build any physical reasoning. The other objection is, that the dissipation of energy must go on even in this invisible universe, and the new assumption only delays the inevitable end of all things. The answer made is, that the universe may be regarded as an infinite whole. We have no objection, but the same may be said of the visible universe, and the moment that it is so regarded the arguments on which its end and its beginning are inferred seem to vanish into air. An infinite universe will have an infinite store of energy, and there is no need to suppose that its store is ever exhausted, or that in any finite time it has become practically degraded and unavailable. The whole elaborate machinery of the invisible universe (p. 171), piled one on the top of the other, seems to us to fall like a house of cards, if we can accept the eternal duration of an infinite by-sense-perceptible universe.

The book is written in a simple and persuasive style, with a transparent simplicity and purity of purpose. Once or twice there is an outburst of irrepressible energy, like that on pp. 106 and 107, about wife-beaters, who are to be subjected "by an enlightened Legislature to absolutely indescribable torture, unaccompanied by wound or even bruise, thrilling through every fibre of the frame of such miscreants." But these outbursts are transient, and they relieve the strain on the reader's attention.

THE TIDES OF THE MEDITERRANEAN

Az Arapály Fiumei Obölben (*The Tides in the Roadstead of Fiume*). Prize Essay, published by the Royal Philosophical Society of Hungary. By E. Stahlberger, Professor in the Imperial Royal Marine Academy. (Buda-Pesth, 1874, 4to., pp. 109, with plates and copious tables.)

FEW points in physical geography have had more interest for scientific men than the tides of the Mediterranean. Connected with the Atlantic only by a